

width, with thunder and hail. One person was reported killed at Rose Hill, Kans., one at South Haven, Kans., and 3 persons were killed at Augusta, Kans. A severe thunderstorm moved east over Oklahoma City, Okla., from 9 to 11 p. m., with high wind and hail at 10.03 p. m. High wind caused damage to buildings in Indian Territory. A tornado moved northeast near Bangs, Tex., at 9 p. m., in a path about one-half mile in width, with rain, large hail, thunder, and lightning. The storm had a whirling motion from west to south; one person was killed, and the damage to property in the county was about \$10,000.

A heavy south gale prevailed at Amarillo, Tex., on the 30th, changing to west the evening of the 31st. About 9 p. m. a tornado moved northeast at Santa Anna, Tex. The storm first appeared like a column of smoke, then assumed a funnel shape, and struck the outskirts of the town, destroying a number of buildings. One person was killed and 13 were injured. A second tornado passed along a parallel track about the same time, destroying a number of buildings, and injuring several persons. The storms had a whirling motion, and were attended by rain, hail, and vivid lightning. Near Trickham, Tex., a heavy thunderstorm moved northeast in a path about 300 yards in

width at 8.30 p. m., destroying property to the value of about \$2,000. At Abilene, Tex., the pressure decreased rapidly, with high temperature, brisk to high westerly winds, and a thunderstorm at 8.40 p. m. The storm moved from the southwest, with dashes of rain and hail, and with the first gust of wind from the west the temperature fell from 81° to 50°. Lightning continued until nearly midnight.

At El Paso, Tex., a violent gale prevailed from noon to 7 p. m., with a maximum velocity of 68 miles per hour and an extreme velocity of 82 miles at 5.25 p. m., and wind changing from southwest to northwest. At Warrensburgh, Mo., a thunderstorm moved northeast about midnight, causing damage to property to the extent of about \$10,000. At Adrian, Mo., houses were moved from their foundations by the force of the wind.

At Sioux City, Iowa, light rain began 9 p. m. Thunder was first heard 9.15 p. m., when heavy rain set in with a violent thunderstorm. At 11.15 p. m. the spire of a church was struck by lightning and torn from top to bottom, the pieces being scattered a distance of 100 yards. The positions in which tornadoes were reported on this date are shown on Chart VII.

### INLAND NAVIGATION.

#### STAGE OF WATER IN RIVERS.

In the following table are shown the danger-points at the various river stations; the highest and lowest stages for the month, with the dates of occurrence, and the monthly ranges:

Heights of rivers above low-water mark, March, 1892 (in feet and tenths).

Stations.	Danger-point on gauge.	Highest water.		Lowest water.		Monthly range.
		Date.	Height.	Date.	Height.	
<i>Red River.</i>						
Shreveport, La. ....	29.9	31	16.1	16	7.6	8.5
<i>Arkansas River.</i>						
Fort Smith, Ark. ....	22.0	26	16.0	7	6.0	10.0
Little Rock, Ark. ....	23.0	27	18.9	1	8.5	10.4
<i>Missouri River.</i>						
Fort Buford, N. Dak. *	21.0	29	15.3	2.4	5.9	9.4
<i>Mississippi River.</i>						
Saint Paul, Minn. ....	14.0	11, 12, 13	5.0	26	2.0	3.0
La Crosse, Wis. ....	11.8					
Dubuque, Iowa. ....	16.0	13	5.5	22, 23, 24	3.2	2.3
Davenport, Iowa. ....	15.0	1, 10	4.0	12, 13	2.0	2.0
Keokuk, Iowa. ....	14.0	31	5.2	15, 25, 26	2.8	2.4
Saint Louis, Mo. ....	30.0	10	18.6	23	12.0	6.6
Cairo, Ill. ....	40.0	31	33.3	9	23.6	9.7
Memphis, Tenn. ....	33.0	31	23.8	11, 12	16.9	6.9
Vicksburg, Miss. ....	41.0	3.4	33.6	15	28.0	5.6
New Orleans, La. ....	13.0	9	12.4	20, 21	10.3	2.1
<i>Ohio River.</i>						
Parkersburg, W. Va. ....	38.0	30	21.7	21, 22	7.6	14.1
Cincinnati, Ohio. ....	45.0	31	34.5	22	17.0	17.5
Louisville, Ky. ....	24.0	31	13.1	22	8.7	4.4
<i>Cumberland River.</i>						
Nashville, Tenn. ....	40.0	28	34.3	7	6.4	27.9
<i>Tennessee River.</i>						
Chattanooga, Tenn. ....	33.0	28	10.6	7	4.9	5.7
Knoxville, Tenn. ....	29.0	27	4.8	6	1.9	2.9
<i>Monongahela River.</i>						
Pittsburg, Pa. ....	29.0	28	16.2	22	3.8	12.4
<i>Savannah River.</i>						
Augusta, Ga. ....	32.0	27	27.0	24	8.3	18.7
<i>Willamette River.</i>						
Portland, Oregon. ....	15.0	31	6.4	8, 9, 10	2.2	4.2
<i>Susquehanna River.</i>						
Harrisburg, Pa. ....	17.0	29	13.0	23, 24	2.6	10.4
<i>Alabama River.</i>						
Montgomery, Ala. ....	48.0	28	45.3	6	5.8	39.5

\* River frozen.

† For 28 days.

‡ For 25 days.

#### ICE IN RIVERS AND LAKES AND OPENING OF NAVIGATION.

*Lake Ontario.*—The first vessel of the season arrived at Charlotte, N. Y., on the 31st. She cleared and returned to Toronto in the afternoon. The captain reported considerable ice in the Lake.

*Lake Erie.*—A steamer from Detroit, Mich., arrived at Cleveland, Ohio, on the 28th, and returned to Detroit on the 29th.

This was the first boat of the season. The first boat of the season left Toledo, Ohio, for Monroe, Mich., on the 24th.

*Lake Michigan.*—Two barges and a schooner, the first of the season, cleared from Manistee, Mich., for Chicago, Ill., on the 31st. The Straits of Mackinac were reported open for navigation on the 15th.

*Hudson River.*—On the 28th a steamer of the Albany and Newburgh Line passed down the river, opening navigation.

The Raritan River at New Brunswick, N. J., was covered with ice the early part of the 14th.

*Susquehanna River.*—At Wilkes Barre, Pa., the river was full of floating ice on the 12th. On the 19th the river was clear of ice. At Lock Haven, Pa., the West Branch of the Susquehanna River was partly frozen on the 1st and 2d; frozen on the 3d; 5th, river clear of ice; 14–15th, floating ice; 16th, river clear of ice; 18th, slush ice; 19th, river clear; 21st–24th, frozen; 25th, river clear of ice.

Floating ice was reported in the Alleghany River at Pittsburgh, Pa., from the 15th to 21st.

At Detroit, Mich., the river was full of floating ice on the 24th and 25th. The steamer that left for Cleveland, Ohio, encountered heavy ice about 15 miles from Cleveland.

Floating ice was reported in the Saint Clair River from the 24th to 27th. The ice began to break up at Marine City, Mich., the morning of the 25th.

The Grand River was opened at Lansing, Mich., on the 2d. The Wisconsin River opened at Plover, Wis., on the 27th.

The Fox River opened at Green Bay, Wis., on the 26th. The Saint Croix River opened at Osceola Mills, Wis., on the 30th.

At Saint Vincent, Minn., the Red River of the North rose rapidly and the ice began to break up on the 30th.

*Mississippi River.*—At Saint Paul, Minn., the harbor and as far down as Dayton's Bluff was nearly clear of ice on the 6th; elsewhere the ice gorge remained. On the 8th ice moved out in the early morning. The river was frozen on the 11th. At Prairie du Chien, Wis., the river opened on the 24th. At Red Wing, Minn., a channel was cut in the ice by ferry boats on the 2d; 5th, ice broke up and river opened as far as could be seen; 9th, large fields of floating ice caused ferry boats to discontinue trips; 10th, river frozen; 11th river frozen and persons crossing on the ice; river reported opened from Winona down; 14th, ferry resumed trips by cutting a channel through the ice; 25th, river opened as far as can be seen; ice on Lake Pepin melting rapidly and unsafe for teams. At Davenport, Iowa,

ferry boats began making regular trips on the 16th; on the 22d the first up-river boat arrived from Saint Louis, Mo., and navigation was practically opened. At Le Claire, Iowa, the river was frozen on the 11th; ice broke up 13th.

**Missouri River.**—At Glendive, Mont., ice broke up in the Yellowstone River on the 11th. At Miles City, Mont., the Tongue and Yellowstone rivers were full of slush ice on the 10th and 11th. At 5 p. m. the Tongue River overflowed and inundated low parts of the city. On the 11th the ice gorge in the Tongue River broke. In the Yellowstone River ice ran out at intervals and again became blocked. At Medora, N. Dak., the Little Missouri River closed on the 16th and opened on the 24th. At Valley City, N. Dak., the Cheyenne River opened on the 5th, closed on the 9th, and again on the 25th. At Yankton, S. Dak., ice broke up on the 8th. At Pierre, S. Dak., the ice was covered with water until the 5th; 7th, 9th,

and 10th, running ice; 11th, heavy ice began running in the Pierre channel, and the Fort Pierre or main channel became gorged; 12th to 19th, running ice; 20th, channel opened on Pierre side; 21st to 23d, some running ice; 24th to 27th, running ice; 28th, ferry boat began making regular trips. Sioux City, Iowa, ice ran out on the 5th, carrying a large section of the pontoon bridge; 6th to 10th and 17th to 19th, running ice; 25th, river full of running ice. Large quantities of floating ice were reported at Leavenworth, Kans., on the 16th and 17th. Navigation opened at Hermann, Mo., on the 19th.

#### FLOODS.

On the 1st the Roanoke River rose 15 feet in 24 hours at Weldon, N. C.

At Montgomery, Ala., the Alabama River rose rapidly on the 27th and 28th, and reached 46 feet, 2 feet below the danger-line, on the 28th, flooding low lands.

## ATMOSPHERIC ELECTRICITY.

### AURORAS.

On the 6th auroras were observed from New England and New Jersey to eastern Montana; on the 12th from New England to western Montana; and on the 24th from the New England and New Jersey coasts to eastern Washington, and southward to the Ohio and lower Missouri rivers.

The following table gives the prominent features of the more important auroral displays of the month:

Date.	Station.	Extent of display.		Remarks.
		Azimuth.	Altitude.	
Mar. 1	Red Wing, Minn. ....	165 to 195	10	Two arches, with rays of light gray to red.
6	Manchester, N. H. ....	.....	60	Bright beams of yellow and green from horizon to zenith.
6	Boston, Mass. ....	135 to 270	70	An arch, with bright patches of light.
6	Woods Holl, Mass. ....	135 to 215	40	Vertical bands of white light.
6	New Haven, Conn. ....	Cov'd 90	35	An arch, with brilliant streamers.
6	Atlantic City, N. J. ....	135 to 210	25	Display of a bluish tinge.
6	New York, N. Y. ....	Cov'd 45	20	White streamers to altitude 35°.
6	Oswego, N. Y. ....	In the N.	25	A greenish arch, brightest in northeast.
6	Rochester, N. Y. ....	Cov'd 60	45	Faint streamers to zenith.
6	Detroit, Mich. ....	Cov'd 90	30	Light blue changing to pink.
6	Marquette, Mich. ....	135 to 225	15	Streamers, with wavy sheet of great splendor.
6-7	Sault de Ste. Marie, Mich.	90 to 250	80	Appeared like a huge curtain with folds moving from east to west.
6	Miles City, Mont. ....	Cov'd 90	80	Pale "merry dancers."
12	Manchester, N. H. ....	135 to 210	25	Beams to 90°.
12	Portland, Me. ....	Cov'd 60	10	Appeared as a curtain of light whose folds were moved by the wind.
12	Sault de Ste. Marie, Mich.	80 to 190	30	Arch, green at base and orange at upper margin.
12	Saint Vincent, Minn. ....	90 to 315	*	Varying colors.
15	Block Island, R. I. ....	.....	20	Slender white beams.
24	Eastport, Me. ....	.....	35	Two arches, with streamers and pillars of light, reaching nearly to southern horizon.
24	Manchester, N. H. ....	112 to 245	65	Arch, with bright light to zenith.
24-25	Grand Haven, Mich. ....	.....	45	Two arches of diffused light.
24	Milwaukee, Wis. ....	.....	25	An arch, with streamers nearly to zenith.
24	Saint Paul, Minn. ....	110 to 190	25	Brilliant beams of light to altitude 60°.
24	Huron, S. Dak. ....	140 to 220	25	
24	Pierre, S. Dak. ....	135 to 225	20	
27	Marquette, Mich. ....	135 to 247	35	Two arches, with parallel beams.

\*75° to beyond zenith.

Auroras were reported over the north Atlantic Ocean, as follows: 11th, in latitude N. 42°, longitude W. 51°, at 9 p. m., a bright crimson light in the northern sky visible about 5 minutes. Night of the 11-12th, from N. 42°, W. 45° to N. 43°, W. 40°, bright crimson light in the north. 12th, N. 43°, W. 49°, a brilliant red display with green and white lines. 26th and 27th, from N. 55°, W. 14° to N. 53°, W. 23°, bright northern lights at night.

### THUNDERSTORMS.

Description of the more severe thunderstorms reported for the month is given under "Local storms."

Thunderstorms were reported as follows: East of the Rocky Mountains they were reported in the greatest number of states, 17, on the 26th; in 13 on the 29th; in 12 on the 31st; in 11 on the 22d, 25th, and 27th; in 10 on the 23d and 24th; in 9 on the 8th and 30th; in 8 on the 10th; in 7 on the 6th, 7th, and 17th; in 6 on the 31st; in 5 on the 4th, 5th, and 28th; in 4 on the 9th, 15th, and 18th; in 3 on the 14th and 20th; in 2 on the 3d; and in one on the 1st, 2d, and 16th. No thunderstorms were reported on the 11th, 12th, 13th, and 19th.

East of the Rocky Mountains thunderstorms were reported on the greatest number of dates, 13, in North Carolina; on 12 in Kansas and Texas; on 11 in Arkansas; on 10 in Tennessee; on 9 in Louisiana, Missouri, and South Carolina; on 8 in Florida and Mississippi; on 7 in Alabama, Georgia, and Oklahoma Territory; on 6 in Illinois, Indian Territory, and Kentucky; on 5 in Iowa; on 4 in Maryland, Michigan, South Dakota, and West Virginia; on 3 in Nebraska, New Jersey, Ohio, and Wisconsin; on 2 in Delaware, Montana, and Pennsylvania; and on one in Connecticut, District of Columbia, Maine, Massachusetts, Minnesota, New York, and Virginia.

West of the Rocky Mountains thunderstorms were reported in Arizona on the 1st, 2d, 3d, 5th, 6th, and 24th; in California on the 14th, 15th, 20th, 22d, 23d, 26th to 31st; in Colorado on the 2d, 14th, 15th, 24th, 28th, and 31st; in Nevada on the 13th, 17th, and 18th; in New Mexico on the 1st to 4th, 6th, 14th, 15th, 23d, and 31st; in Oregon on the 13th, 14th, 17th, 18th, 26th, and 28th; in Utah on the 2d, 19th, 23d, 25th, and 30th; in Washington on the 24th and 28th; in Wyoming on the 8th. In states and territories other than those named no thunderstorms were reported.